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THE BATTLE COMMAND SUSTAINMENT SUPPORT SYSTEM: INITIAL ANALYSIS REPORT

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September 2016

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14. ABSTRACT

The tactical applications (TacApps) team's initial analysis of the Battle Command Sustainment Support System (BCS3) has focused on setting up a BCS3 demo environment, analyzing BCS3 software code, ingesting available documentation, and understanding the specific data feeds upon which the National Enterprise Data Portal (NEDP) component of the BCS3 depends. Also included is an analysis of the Global Combat Support System – Army data integration. The NEDP data feeds are typically delivered via flat file or direct database link. Frequency of delivery ranges from 15 min to 24 hr, though many fall in the 2 to 6-hr range. Data from April 2012 indicates a total BCS3 data throughput (including both user interaction and data feed consumption) of 0.12 kilobytes per second, which is very low compared with the throughput expected of the TacApps backend. Efforts are underway to confirm the validity and timeliness of this data. Further details of the analysis are contained within this report.

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INTRODUCTION

The Battle Command Support and Sustainment System (BCS3) is a sustainment component of the U.S. Army Battle Command System (ABCS) suite. The BCS3 is used for logistics tracking including in-transit visibility of deployment, redeployment, and sustainment shipments; supply-point asset visibility (AV); equipment maintenance status; and unit logistics status. In April of 2015, the Weapons and Software Engineering Center (WSEC) tactical applications (TacApps) team received a task order from Product Manager Tactical Mission Command to analyze the BCS3 in support of a potential future TacApps integration effort. The initial analysis plan delivered by WSEC outlined a strategy that emphasized analysis of the National Enterprise Data Portal (NEDP) component of the BCS3 and its associated data feeds. This area was identified as the most relevant to future integration efforts. The initial analysis of the BCS3 and its NEDP is described in this report.

The BCS3 analysis includes an examination of the legacy BCS3 code to identify the relevance of each code folder to a potential future TacApps integration. The analysis also includes identifying and documenting how each data feed is consumed and processed as well as identifying problems that might arise with a TacApps implementation of feed consumption. Additionally, as part of the analysis, WSEC will investigate the Global Combat Support System - Army (GCSS-A) in order to identify overlap between GCSS-A and NEDP feeds with a focus on areas in which GCSS-A data may be used in lieu of legacy NEDP feeds.

BATTLE COMMAND SUPPORT AND SUSTAINMENT SYSTEM/GLOBAL COMBAT SUPPORT SYSTEM - ARMY OVERVIEW

The BCS3 is the only sustainment component of the ABCS suite. The BCS3 is used for a large number of applications including in-transit visibility of deployment, redeployment, and sustainment shipments; supply-point AV; equipment maintenance status; and unit logistics status using bottom-up reporting.

The BCS3 is designed to be used at every echelon, from company to theater sustainment command and across all types of formations, from brigade combat teams to all types of support brigades and division and corps headquarters. The BCS3 is the only ABCS component that can operate on both classified and unclassified networks. It provides this broad spectrum of capabilities across all formations in the active U.S. Army, U.S. Army National Guard, and U.S. Army Reserve (as well as formations in the U.S. Marine Corps and other governmental organizations).

The GCSS-A program is an acquisition category 1AM Major Automated Information System program. The GCSS-A is the primary tactical enabler of the U.S. Army's sustainment transformation. The program consists of two components: a functional component for deployable forces called GCSS-A and a technical enabler component called the U.S. Army Enterprise Systems Integration Program.

EFFORT SUMMARY

To date, WSEC's efforts have primarily revolved around configuring a BCS3 demo environment to work on the WSEC development network as means through which to examine BCS3 code and functionality. The demo environment consists of six virtual machines that must run simultaneously on a single host computer. The demo allows WSEC developers to view BCS3 functionality with static data. This capability enhances WSEC's ability to analyze the BCS3 codebase and interpretation of data feeds. With limited available documentation, use of the demo

along with manual code analysis has been one of the few practical means by which to execute the analysis plan to date.

Recently, representatives from Tactical Edge, Inc., San Diego, CA, visited WSEC engineers at the U.S. Army Armament Research, Development and Engineering Center, Picatinny Arsenal, NJ, for a technical exchange meeting (TEM). Tactical Edge operated as a subcontractor to the International Business Machines Corporation (IBM, Inc.) during development of the BCS3 software. Tactical Edge engineers possess in-depth technical knowledge related to both BCS3 and the NEDP. Access to these engineers has become an option only recently; however, the addition of this expertise has greatly impacted the analysis efforts. During the TEM, Tactical Edge engineers provided a detailed overview of the NEDP architecture and discussed various NEDP data feeds extensively. This technical exchange and future iterations will greatly enhance the final results of the analysis.

POTENTIAL ROADBLOCKS

During the TEM with WSEC developers, Tactical Edge engineers revealed the fact that BCS3 is completely undocumented. According to Tactical Edge engineers, all of the available documentation refers to BCS3-NM (node management) only. While BCS3 and BCS3-NM both sit on top of the NEDP, the two systems are separate baselines and use mostly different data feeds. A review of the documentation that WSEC received from IBM confirmed that all of the detailed documents (i.e., software design description) are written for BCS3-NM, not BCS3. The WSEC developers are also currently reviewing additional documentation received from the Software Engineering Center.

As part of the analysis effort, WSEC will leverage Tactical Edge engineers in an attempt to document all of the BCS3-specific data feeds. This information will be included within the final analysis. Although likely lacking in detail compared to a contract deliverable software design description or similar document, the data feed documentation generated by WSEC will provide a substitute for the nonexistent BCS3 documentation to aid in future software efforts.

NATIONAL ENTERPRISE DATA PORTAL ANALYSIS

The NEDP is comprised of an Oracle Database 10g referred to as the National Data Server and several other components. The Oracle Database 10g was the first database designed for grid computing, which is considered a flexible and cost-effective way to manage enterprise information. The g in 10g stands for grid to indicate that the database is grid-computing-ready. Grid computing introduced shared resources through which an instance can use (for example) central processing unit resources from another node (computer) in the grid. This improves the scalability and performance of the database. Oracle Database 10g also boasts many other features that improve the efficiency of the system such as self-tuning features, the ability to transport tablesspaces across machines and operating systems (e.g., Windows to Unix), automatic database diagnostic monitoring, asynchronous commits, and others.

The other components of the NEDP include a main forwarding gateway/web server and one or more data forwarding gateways (DFG). Together, with the Oracle Database 10g, these components provide a heterogeneous data source that aligns various data feeds into a common operating picture, which, in turn, allows the warfighter to locate, manage, and track commodities as they move through the various aspects of the distribution pipeline. This also allows commanders to view user defined reports, previously known as combat power reports.

According to documentation from 2012, the BCS3 as a whole generates 10.25 MB worth of traffic a day (or about 7.12 KB/min). This includes both feeds and users. These statistics are taken from the production system in March/April 2012. By comparison, the Command Post of the Future (CPOF) is roughly considered to use around 30 KB/sec on average (this is an estimated number and should not be considered authoritative). By this estimation, the CPOF actually handles approximately 250 times more data than the BCS3 on any given day. These numbers are pending confirmation by Tactical Edge engineers and are also likely to update significantly as the feeds themselves are updated to increase in frequency. In terms of size, the BCS3-NM maps database is roughly 160 GB, and the other databases are generally in the range of several hundred GB.

FEED DEPENDENCIES

It is important to note that there are no dependencies between the various NEDP data feeds. If one feed goes down, the other feeds will not be impacted. Data from other feeds will continue to be usable and searchable by the NEDP. While a feed is down, the NEDP will naturally be unable to acquire the latest data, and therefore, certain records will not update. The net result to the user is that while feeds are down, outdated data may appear to be up-to-date in user reports. This burdens the user with the cognitive task of assessing the validity and staleness of data. In future efforts, a mechanism to update data with meta-information based on feed status might help to improve the user experience.

For logistics feeds, data across the feeds is reconciled by a transportation control number (TCN). All incoming updates must include a TCN. The TCN is used to map records across the various feeds to a single shipment.

DATA FEEDS

An initial analysis of each of the data feeds is detailed in the following section. This section is incomplete as some feeds have yet to be reviewed; these sections will be delivered with the final analysis report. Ultimately, each feed description will be further detailed to provide higher accuracy and more complete information.

Logistics Support Activity (LOGSA)

- Frequency: 2 or 6 hr
- Format: direct database link or flat file via secure file transfer protocol (SFTP)

The LOGSA data is broken up into five separate feeds. The Standard Army Ammunition System-Modernization (SAAS-MOD), Standard Automated Maintenance System (SAMS), and Standard Army Retail Supply System– Level 1 (SARSS-1) come from the Integrated Logistics Analysis Program (ILAP) and are updated every 2 hr via a direct database link. The Standard Army Retail Supply System– Level 2 (SARSS-2AC) come from the Logistics Integrated Database (LIDB) and is updated every 6 hr via flat file transferred via SFTP. Property Book and Unity Supply – Enhanced also comes from the LIDB and is updated every 2 hr via a direct database link.

The LOGSA feeds provide closeout records for shipments received by requestors. The LDRA files are closeout records from LOGSA. They contain all of the items that have been reported as received at the supply activity. In the NEDP, receipt of an LRDA file will result in deletion of all TCN, or shipments, from the database that associated with the LDRA file.

- LOGSA Use Case:
    - User generates closeout document for receipted materials in SARSS. This generates an LDRA file.
    - LDRA data passed to the NEDP Oracle database via SFTP.
        - A procedure reads the LDRA file to extract the document numbers and compare them with the document numbers in existing itv_l6_nsn tables and mark the records found as closed. When all national stock numbers (NSN) of a specific TCN are marked "Y," then the TCN is deleted from the BCS3-NM system.
    - The create LKL TRP file procedure that is triggered every 15 min will include the instances where the TCN is to be closed and next LKL TRP master or delta file is sent to the main receiver.
    - The main receiver will zip the file and send it to the subordinate DFG. Data is parsed into destination folders as a .gz file.
    - Zipped files arrive in C:\itvrecv\feed directory on the BCS3-NM workstation. The LKL TRP is generated with a "Y" for the specified TCN.
        - The TRP is parsed into a destination folder and sent to the workstation.
        - The TCN specified with a "Y" is closed along with the lead TCN.

U.S. Marine Corps Equipment Readiness Information Tool

- Frequency: 24 hr
- Format: flat file via SFTP

U.S. Army Human Resources System

- Frequency: 24 hr
- Format: flat file via SFTP

Support Planning Integrated Data Enterprise Readiness System

- Frequency: 24 hr
- Format: flat file via SFTP

Defense Logistics Agency Integrated Data Enterprise Business System Modernization – Energy (BSM-E)

- Frequency: 24 hr
- Format: flat file via SFTP

The BSM-E provides the NEDP with information on worldwide procurement, inventory, shipment, receipts, and distribution management of military specification petroleum products including jet fuels, distillate fuels, residual fuels, automotive gasoline, specified bulk lubricating oils, aircraft engine oils, fuel additives, alternative energy technologies, and crude oil. The BSM-E also provides supporting information such as the Defense Energy Support Center centric Department of Defense (DoD) acquisition advice codes associated to fuel tankers.

- The BSM-E data is received from the integrated data environment (IDE) via SFTP and stored in the Oracle database until a client makes a request.
- When the clients request a subscription or an on-demand query, the web server submits the request to the database.
- The client goes into a polling cycle checking for updates to the request.
- The database generates an extensible markup language (XML) file that is stored on the web server.
- The database only generates a new XML file when a matching file does not exist or when there is newer data in the database.
- Previous requests are stored in a directory; the web server will immediately notify the client when the results are available.
- When the update is available, the client begins to download and parse the results into the local database.

Defense Logistics Information Agency, Asset Visibility

- Frequency: 24 hr
- Format: flat file via SFTP

The AV provides the NEDP with current ammunition, blood, bulk fuel inventory and shipment, requisition, unit equipment, war reserve, and wholesale/retail inventory data. This interface provides the data that allows for the capability to provide users with timely and accurate information on the location, movement, status, inventory, and identity of units, equipment, and supplies.

- The AV data is received from the IDE via SFTP and stored in the Oracle database until a client makes a request.
- When the client requests a subscription or an on-demand query, the web server submits the request to the database.
- The client enters a polling cycle checking for updates to the request.
- The database generates an XML file that is stored on the web server.
- The database only generates a new XML file when a matching file does not exist or when there is newer data in the database.
- Previous requests are stored in a directory; the web server will immediately notify the client when the results are available.
- When the update is available, the client begins to download and parse the results into the local database.

Department of Defense Activity Address File

- Frequency: upon update
- Format: flat file via SFTP

Federal Logistics Data (FEDLOG)

- Frequency: monthly
- Format: digital versatile disc (DVD)

The NEDP uses FEDLOG to update the reference table to associate a line item number, national item identification number, nomenclature, or tables of authorized materiel to the commodity items if they are not provided in the source feed.

The NEDP also uses the FEDLOG reference table to determine the class of supply of the commodities if they are not provided by the source providers. This is done by using the first four characters of the NSN, which is known as the Federal Supply Code (FSC). The BCS3-NM references the FSC of the NSN against a table provided by the Office of the Deputy under Secretary of Defense Logistics and Military Readiness.

The NEDP receives a monthly update of the FEDLOG DVD that will be used to create a monthly update (consisting of only add, deletes, and changes) that will be forwarded to the client workstations.

- FEDLOG Delta data obtained from a manual extract and compare will be updated in the Oracle database using import scripts.
- Once completed, a manual procedure is initiated to create a FEDLOG and part number TRP file that is sent to the main receiver.
- Main receiver will zip file and send it to subordinate DFG. Data is parsed into destination folders as a .gz file.
- Zipped files arrive in C:\itvrecv\feed directory on BCS3-NM workstation.
- The FEDLOG and part number TRP files are parsed into the support database replacing the appropriate fields.

Commercial Air Carrier Data (214A)

- Frequency: unknown
- Format: flat file via SFTP

The 214A data is delivered in the form of motor carrier shipment status messages that support the motor carrier compliance application in the form of operational data. Operational data provides movement requirements to include shipment detail, routing, and carrier selection detail. This set of transactions can be used by a transportation carrier to provide shippers, consignees, and their agents with the status of shipments in terms of dates, times, locations, route, identifying numbers, and conveyance.

- The 214 commercial carrier data obtained from source providers is updated in the Oracle database using import scripts.
- Every 15 min, a procedure is triggered to create an LKL TRP file that is sent to the main receiver.
- Main receiver will zip file and send it to subordinate DFG. Data is parsed into destination folders as a .gz file.
- Zipped files arrive in C:\itvrecv\feed directory on BCS3-NM workstation.
    - The LKL TRP files are parsed into the support database replacing all of the fields.
    - The client can select to stop receiving LKL TRP files.

Global Air Transportation Execution System (GATES)

- Frequency: unknown
- Format: flat file via SFTP

The GATES supports headquarters U.S. Army Materiel Command (AMC) fixed aerial ports and deployed aerial ports. The GATES processes and tracks cargo and passenger information; supports management of resources; provides logistical support information; supports scheduling and

forecasting; provides tracking and tracing of aerial port assets (including personnel, vehicles, equipment, and supplies); supports processing service/agency short-range cargo requirements and long-range passenger and cargo requirements; provides passenger movement requirements and airlift capabilities information available in the system to allow AMC to plan and execute DoD international common user passenger channel travel; supports channel mission management; manages tariff data regarding baggage, passenger, and pet fares; manages passenger reservations; and provides reports/transportation status for AMC and AMC customers. The GATES processes reservations for travel aboard AMC owned and contracted aircraft for DoD transportation offices and provides premanifests to the GATES port level application at fixed aerial ports and contracted commercial airport gateways worldwide.

- The GATES data obtained from source providers are updated in the Oracle database using import scripts.
- Every 15 min, a procedure is triggered to create an LKL TRP file that is sent to the main receiver.
- Main receiver will zip file and send it to subordinate DFG. Data is parsed into destination folders as a .gz file.
- Zipped files arrive in C:\itvrecv\feed directory on BCS3-NM workstation.

    - The LKL TRP files are parsed into the support database replacing all of the fields.
    - The client can select to stop receiving LKL TRP files.

Radio-frequency Identification (RFID) Detections, Level 6, and Interrogator Locations

- Frequency: 15 min
- Format: direct database link

The NEDP uses a materialized view of the database replication between the NEDP and the radio frequency in-transit visibility (RF-ITV) regional data server to get updates every 15 min. Radio frequency burn data is linked with the shipping containers (e.g., pallets, loaded military vans, Container Express containers, etc.) to identify and track contents. The RFID data includes TCNs associated with the shipment data along with commodity level detail. Cargo with an RF tag updates the RF-ITV regional data server as they pass by interrogators. This data feed is received on both the nonsecure internet protocol router (NIPR) and the secure internet protocol router (SIPR) networks.

This RF data is then merged with the International Data Environment/Global Transportation Network Convergence (IGC) data using custom queries to fill in missing data.

- Replica of Joint-Automatic Identification technology (J-AIT) database is stored on the NEDP Oracle database.
- Materialized view of the BCS3 Oracle is stored in the BCS3-NM Oracle. Every 15 min, a procedure is triggered that merges the RF data with the IGC data to create an LKL TRP file that is sent to the main receiver.
- Main receiver will zip file and send it to destination clients. Data is parsed into destination folders as a .gz file.
- Zipped files arrive in C:\itvrecv\feed directory on BCS3-NM workstation. The data is not displayed in BCS3-NM until a filter is created that includes the TCN data.

    - The LKL master files are parsed into the support database replacing all of the fields.
    - Deltas will append data to the fields generated by the master TRP.

- The client can select to stop receiving LKL TRP files if desired.

Transponder Location 5.13 Extensible Markup Language Feed

- Frequency: real time
- Format: XML via hypertext transfer protocol secure (HTTPS) web service

This data feed is received on both the NIPR and SIPR networks.

Last Tactical Mile in Transit Visibility (LTM-ITV)

- Frequency: real time
- Format: flat file via Theater Information Management (TIM) HTTPS

The LTM-ITV provides BCS3-NM with a satellite-tracking system that also includes the ability to track RFID tags associated with the vehicle that is transporting it. This information allows BCS3-NM to view the contents of an RFID from the point it is loaded on a vehicle to the point it is delivered.

The LTM-ITV contains transponder locations during shipments' last tactical mile. The LTM-ITV data along with transponder data received from the J-AIT and Global Deployment Management System (GDMS) data providers are populated in the NEDP Oracle database. The data from these tables is used to generate the 13 different TRACK TRP files that are transferred to the structured query language (SQL EXPRESS) support database on the BCS3-NM client. The data received from LTM-ITV that contains associated RFID or lead TCN cargo will be merged into to the LKL tables. If the cargo does not contain an RFID or lead TCN, it will only be associated with the vehicle that is transporting it.

World Port System

- Frequency: upon request
- Format: flat file via STFP

Integrated Booking System – Container Management Module

- Frequency: 1 hr
- Format: flat file via SFTP

Movement Tracking Systems

- Frequency: on use
- Format: XML and SMTP via a virtual private network (VPN) connection

Global Transportation Network (GTN)

- Frequency: on use
- Format: GTN query via secure shell tunnel

Global Deployment Management System

- Frequency: real time
- Format: flat file via TIM HTTPS

The GDMS provides the NEDP with information from commercial satellite-tracking systems feeds. The GDMS transponder information is merged with data received from the LTM-ITV and J-AIT feeds.

Global Combat Support System – Army Analysis

Although current GCSS-A planning includes replacement of all LOGSA data sources, this will not impact the NEDP. The GCSS-A is gradually decommissioning the LOGSA servers. Current understanding is that as this happens, GCSS-A will being to provide the AV data to LOGSA. The LOGSA will, in turn, provide this data to the NEDP; thus, the NEDP will continue to consume this data through LOGSA. The GCSS-A currently has no requirements to interface directly with the NEDP or TacApps. This will only become an issue if a future version of TacApps needs access to GCSS-A data directly.

CONCLUSIONS

The National Enterprise Data Portal (NEDP) is a large, complex system ingesting data from a multitude of sources. Initial analysis indicates integrating the NEDP into Tactical Applications (TacApps) and the command post computing environment will be a nontrivial task with a significant level of effort required. The feasibility of integrating the feeds directly into the Mission Command Data Service (MCDS) without the use of the NEDP has yet to be determined. The remainder of the Battle Command Sustainment Support System (BCS3)/NEDP analysis will focus on reviewing the remaining data feeds and BCS3 software to achieve the following goals that align with the original analysis plan:

- Provide rationale that recommends either integrating NEDP with TacApps or consuming feeds directly into the MCDS.
- Reduce the cost and schedule needs of future BCS3 TacApps integration efforts by understanding:
    - Data model implications.
    - Data throughput, bandwidth, and storage needs.
    - Conflict resolution and business logic requirements.
- Document data and interfaces.
- Understand system and domain to assist with estimating BCS3 TacApps integration cost and staffing requirements.

The TacApps team expects that these goals will be achievable in the timeframe given, provided that Tactical Edge, Inc. engineering support continues to be available and forthcoming. As key areas of the NEDP are illuminated, current technical planning includes involvement of current Semantically Extensible Attribute Model (SEAM) 2.0/Mission Command Data Model modelers and MCDS developers in the BCS3 analysis for both input and situational awareness. The addition of these personnel is key to understanding the implications of logistics data integration into MCDS and will result in a more complete final analysis report.

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